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NOTES ON GEOGRAPHIC DISTRIBUTION

Pisces, Siluriformes, Ictaluridae, *Ictalurus punctatus* (Rafinesque, 1818): First record in middle Paranapanema river reservoir, aquaculture and exotic species dispersion

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ABSTRACT: This is the first report of *Ictalurus punctatus* in the middle Paranapanema river basin; the occurrence of this species may be associated with the expansion of pisciculture in cage farms in the Brazilian territory as a whole.

The channel catfish has its natural distribution along the states of the Gulf of Mexico and the Mississippi valley in the United States (Wellborn 2009). In natural conditions, it lives in rivers of moderate and fast water velocity; however, it can also be found in great numbers in great reservoirs and lakes. In all ecosystems, it can live on the bottom of rivers that range from rocky, to sandy or gravelly; however, the species prefers muddy bottom surfaces and clear water. Although the channel catfish is a freshwater species it also colonizes saltwater, particularly clear water, but can also be found in turbid water (Wellborn 2009). Lovell (1989) and Kim and Lovell (1995) highlight that the species presents a satisfactory growth at temperatures from 19.9 °C to 29 °C.

With regard to natural feeding, the capture of food occurs during daylight or night; juveniles feed on aquatic insects, mollusks, gastropods, crustaceans, green algae, aquatic plants, seeds and small fish. Interestingly, in adults, fish represents more than 75 % of the diet (Wellborn 2009). In natural conditions, females of this species spawn on average about three to four thousand eggs/kg of total weight; spawning occurs only once in a year in nursery made of rocks or even trunks in isolated areas and with low light. Parental care is carried out by males, who take care of the airing of eggs and removing undesirable material with their barbels. This species generally reaches gonad maturity at three years of age; however, there are some studies that report that they might be sexually mature at two years of age (Wellborn 2009).

In addition to being important for sport fishing (Simmons *et al.* 2006), the channel catfish is also one of the species most used in American aquaculture, as it presents an increased production development, corresponding to more than 70 % of fishery production (Goldburg *et al.* 2001). Its meat has an excellent taste and high nutritive value, making a good alternative for intensive culture (Gomes and Schlindwein 2000). Due to its peculiarities, *I. punctatus* was introduced gradually in various continents (Wellborn 2009). In Brazil, the first record of its use in aquaculture was in 1972, in the Northeast region; in the southern region its first record was in 1980 (Piedras 1990).

However, aquaculture that uses non-native species can promote damage to the environment and biodiversity, and is recognized as the main factor responsible for the introduction of exotic species (Agostinho *et al.* 2007). According to FAO (1998), from a total of 3,141 new registered introductions, 1,386 (38.7 %) were generated by this activity. Bartley and Casal (1998) reported the impact caused by the introduction of new species divided into two categories: 1 – biological, which include the genetic and ecological impacts, and 2 – social-economic. These authors even relate that these two categories are inter-independent and that social-economical changes frequently reflect in more biological alterations.

In order to characterize the composition and icthyofauna structure associated with the cage farm system, an investigation was conducted in a private cage farm of approximately 500 cage tanks of 18 m^3 each in the Chavantes reservoir. As a control, another region without cage tanks of the reservoir was used (Figure 1). The fish samplings were collected monthly for 12 months, starting in February 2007. The fish were captured by gillnets of different sizes that were exposed for about 18 hours between two daily supervisions.

A total of 1,730 fish of 20 different species were sampled in this area (independently from the track) with an unexpected capture of two specimens of *I. punctatus*, located next to the farm system. This occurrence characterizes the first record of this non-native species in the Chavantes reservoir (middle Paranapanema river, which belongs to the high Paraná basin) (specimens are maintained in the fish Collection of São Paulo State University, São Jose do Rio Preto campus, DZSJRP 11.419). Orsi and Agostinho (1999) recorded the first occurrence of this species in the lower Paranapanema river, where these

fish were also found to originate from fish farms installed along the river basin.

Holle and Simberloff (2005) suggested that the invasion success is dependent on ecologic resistance (factors such as abiotic conditions, environmental disturbances, strategies of living from native species and community structure) and the pressure from the propagule (quantity and strategy of life from the invasive species). Considering these two factors, Agostinho *et al.* (2007) argued that the chance of success of an invasive fish and the establishment of a specific species in a reservoir is facilitated by the continuous disturbances of dams. These disturbances occur from the creation phase until the operational procedure of the dam, leading to the formation of empty ecological niches, facilitating the establishment of new species. On the other hand, considering that the cage farms in a basin are a propagule dispersal agent, due to handling of species, the escape of individuals is inevitable. One of the most reported examples in the literature is the dispersion and the establishment of Curvina (*Plagioscion squamosissimus* Heckel, 1840) throughout the basin of high Parana; this has occurred due to fish farming activities, and/or restocking, in the 1970's (Agostinho *et al.* 2007).

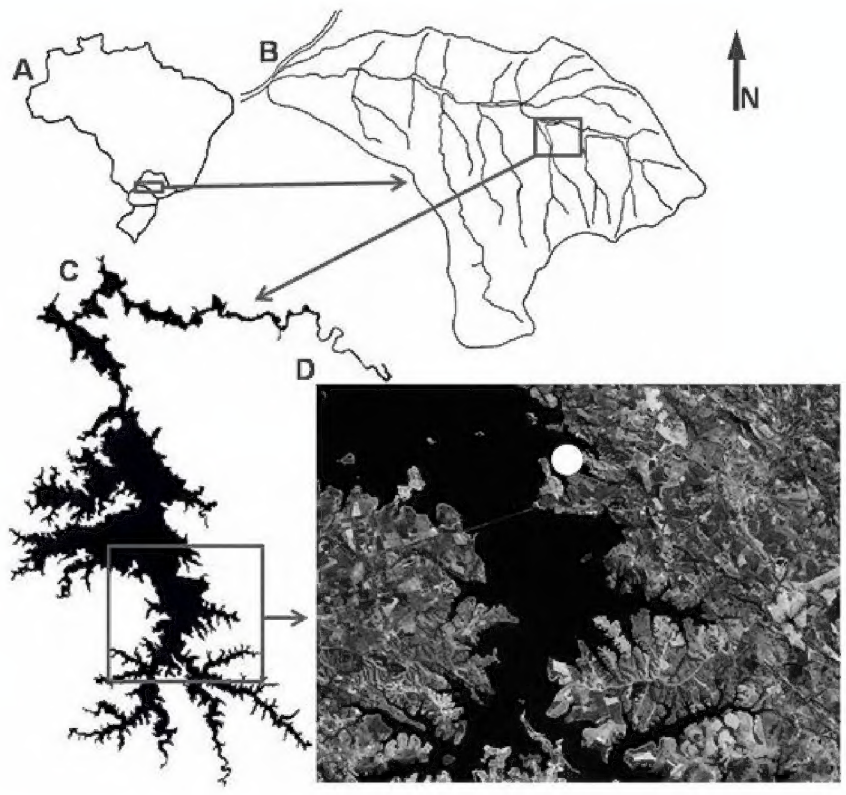

Figure 1. A) Brazil's Map, B) The Paranapanema river and its tributaries, C) Chavantes reservoir and, D) Satellite image (Google Earth), highlighting the capture area of the animals.

Recently, several cage farm systems were installed in the Chavantes reservoir, where different non-native species (mainly tilapias and its hybrids) are reported to breed (Nogueira *et al.* 2006). The breeding of *I. punctatus* in cage farms of a mesotrophic reservoir, which has a damaged icthyofauna due to the presence of a dam, is surprising due to the potential that the species presents as a new propagule. The Chavantes reservoir presents highly limnological conditions (Perbiche-Neves and Nogueira 2010) and the temperature of the reservoir could provide good physiological conditions for the recruitment of new individuals. Wellborn (2009) affirmed that, in the natural environment, this species presents great niche occupancy (for space as well as for food). For this reason, the piscicultures do not use monosex strands of this species, which according to Davis and Goudie (2007) may present an advantage. Instead, farms use propagules with young males and females, which can increase recruiting chances in the natural environment. Reinforcing this issue, studies of Holden and Stalnaker (1975) and Marsh and Brooks (1989) showed that, after the establishment of *I. punctatus* in the basin of the Colorado river (USA), there was a decrease in the number of native species. In addition, Tyus and Nikirik (1990) studied the life strategies of the channel catfish after its introduction in the basin of the Green and Yampa rivers (USA), and observed that it preys or competes directly for food and space, with the native species causing great damage to the icthyofauna.

In conclusion, monitoring of this species is suggested along the reservoir. Despite the low number of individuals sampled, the occurrence of *I. punctatus* in the Chavantes reservoir causes great concern, due to its invasive potential in natural or semi-natural environments. Moreover, it is important to discuss whether the current pisciculture management follows the regulations of Brazilian law (*Decreto nº 4.895*, November 25th 2003; and *Instrução Normativa Interministerial* nº 06, May 31st 2004), which are based on: (i) sustainable development, (ii) increase in the amount of national fishery production; (iii) social inclusion and, (iv) food safety.

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